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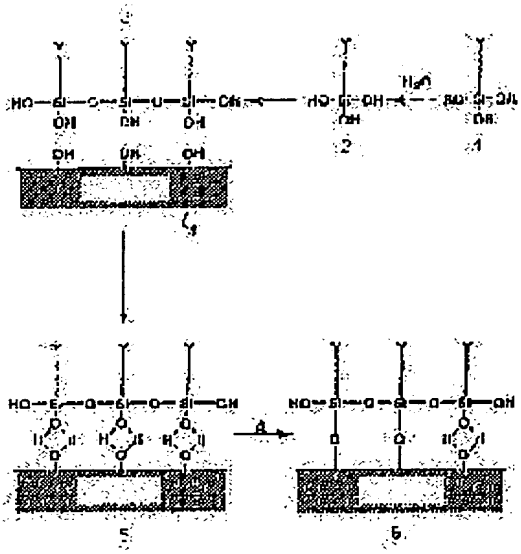
(54) SPACER FOR LIQUID CRYSTAL DEVICE AND LIQUID CRYSTAL DEVICE USING SAME

(57)Abstract:
PURPOSE: To orient liquid crystal molecules perpendicularly and to prevent abnormal orientation of liquid crystal molecules in the interface between the liquid crystal molecules and spacers by coating the surface of the spacer with a thin film consisting of a specified silane coupling material.
CONSTITUTION: Halogen atom and/or alkoxy groups in a silane coupling agent 1 are hydrolyzed to produce substd. silanoles 2. In formula, Y represents groups having 1 to 5 Debye units dipole moment. Then the substd. silanoles 2 are condensed to produce a condensate 3. Hydroxyl groups in the condensate form a hydrogen bonded body with hydroxyl groups on the surface of a spacer or surface of a titanium oxide layer formed on the surface of the spacer 4. By heat treating the hydrogen bonded body 5, the bonded body 5 is changed into Si-O couplings which are firmly bonded to produce a bonded body 6. Thus, a thin film produced from the silane coupling agent is formed on the surface of the spacer 4. Thereby, by using this spacer for a liquid crystal device, liquid crystal molecules can be perpendicularly oriented.



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* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The spacer for liquid crystal display components characterized by coming to carry out the coat of the front face with the thin film which consists of a silane coupling agent with the radical which has the dipole moment of 1-5 debyes.
[Claim 2] The spacer for liquid crystal display components characterized by coming to carry out the coat of the front face with the thin film which consists of a silane coupling agent expressed with a general formula (1) and (2).
R1 SiX3 (1)
(However, R1 expresses the radical which has the dipole moment of 1-5 debyes, and X expresses an alkoxy group or a halogen atom.)
R2 SiX3 (2)
(However, R2 expresses the hydrocarbon group of carbon numbers 1-20, and X expresses an alkoxy group or a halogen atom.)
[Claim 3] The liquid crystal display component which consists of the transparence substrate with which a couple counters, the insulator layer prepared on each field of this transparence substrate which counters, the transparence electric conduction film prepared on each of this insulator layer, the orientation film prepared on each whole surface of this transparence electric conduction film, liquid crystal intermingled between the orientation film which this counters, and a spacer for liquid crystal display components according to claim 1 or 2.

[Translation done.]

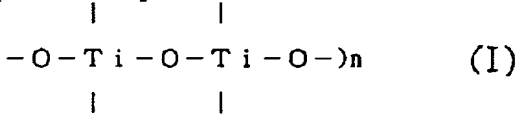
* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the liquid crystal display component for which it comes to use the spacer for liquid crystal display components and this spacer for liquid crystal display components which can promote the vertical orientation of the liquid crystal molecule in an interface, and can prevent the abnormality orientation of a liquid crystal molecule, and may be distributed bywater.
[0002]
[Description of the Prior Art] In the liquid crystal display component, it was common knowledge before that there is a possibility of the orientation of a liquid crystal molecule becoming irregular by the interface of liquid crystal and a spacer, and reducing display quality. In the liquid crystal display component using the super-twisted-nematic liquid crystal (STN LCD) used abundantly especially recently, the abnormality orientation phenomenon of the above-mentioned liquid crystal tends to happen.
[0003] When the above-mentioned abnormality orientation happened and burning actuation of the liquid crystal display component is carried out, the white field called a domain to the perimeter of a spacer appears. When this domain occurs around many spacers, it will be connected mutually and will seem that the white line has connected many spacers. This white line is called a disclination line and is well known as what the abnormality orientation of a liquid crystal molecule is characterized. When many this disclination line appears, the display quality of a liquid crystal display component is made to deteriorate remarkably.
[0004] It was also common knowledge to disappear, when a liquid crystal molecule carries out orientation of the above-mentioned disclination line vertically by the interface of liquid crystal and a spacer and abnormality orientation is solved. In order to promote the vertical orientation of the liquid crystal molecule in the interface of a liquid crystal molecule and a spacer, in JP,57-613,A, JP,64-59212,A, JP,2-23317,A, JP,2-297523,A, JP,3-69917,A, etc., the front face of a spacer is processed by a silane coupling agent etc., and the method of promoting vertical orientation is proposed.
[0005] Moreover, although the Freon-113 grade has been used abundantly as a dispersion medium when distributing a spacer to a substrate conventionally, the activity of Freon -113 comes to be regulated severely, and moisture powder which uses water for a dispersion medium as the substitute is performed increasingly by the end of today when destruction of the ozone layer by fluorocarbon gas has posed a problem.
[0006] In order to perform the above-mentioned moisture powder, to be hard to tend distribute the usual spacer, especially the spacer of a plastics system in water and to improve this point although the spacer itself must distribute easily in water For example, in JP,4-96902,A, when carrying out the suspension polymerization of a cross-linking monomer and the non-cross-linking monomer and preparing a spacer, the water-dispersion spacer which is obtained by adding a hydrophilic monomer and which improved remarkably is proposed.
[0007] Moreover, in the Japanese-Patent-Application-No. No. 30735 [three to] description, oxidize the front face of a spacer by active oxygen, a polar group is made to generate, the approach of giving a hydrophilic property is proposed, and the approach of giving a hydrophilic property is proposed in the Japanese-Patent-Application-No. No. 180968 [three to] description by covering the front face of a spacer with the polycondensation object thin film of an aluminum alkoxide.
[0008] Although a spacer and the spacer of a hydrophilic property effective in prevention of abnormality orientation have been conventionally proposed separately as above-mentioned, the spacer having the abnormality orientation prevention effectiveness and a hydrophilic property is not proposed at all until now.

[0009]
[Problem(s) to be Solved by the Invention] This invention is by carrying out vertical orientation of the liquid crystal molecule in view of the above-mentioned situation to offer the liquid crystal display component for which can prevent the abnormality orientation of the liquid crystal molecule in the interface of a liquid crystal molecule and a spacer, and it comes to use the spacer for liquid crystal display components and this spacer for liquid crystal display components which are a hydrophilic property.
[0010]
[Means for Solving the Problem] Invention according to claim 1 is a spacer for liquid crystal display components to which it comes to carry out the coat of the front face with the thin film which consists of a silane coupling agent with the radical which has the dipole moment of 1-5 debyes.
[0011] the vertical orientation of the liquid crystal molecule in the interface of the spacer for liquid crystal display components, and a liquid crystal molecule if the value of the above-mentioned dipole moment becomes small -- happening -- being hard -- if it becomes large, weak electric field will be generated around the spacer for liquid crystal display components, and since the normal orientation of the liquid crystal molecule when impressing an electrical potential difference to a liquid crystal display component is barred, it is limited to 1-5 debyes.
[0012] As a radical whose value of the above-mentioned dipole moment is 1-5 debyes, an acetoxy radical, an amide group, an aldehyde group, an epoxy group, a cyano group, a sulfone radical, a sulfonyl group, a halogeno alkyl group, a pyridine radical, a nitro group, a lactone radical, etc. are mentioned, for example.
[0013] As the above-mentioned silane coupling agent, for example 2-acetoxy ethyltrimethoxysilane, 2-acetoxy ethyl trichlorosilane, 2-acetoxy ethyl methyl dichlorosilane, 2-acetoxy propylmethyl dichlorosilane, acetoxy propyltrimethoxysilane, 3-glycidoxypropyltrimetoxysilane, 2 -(3, 4-epoxycyclohexyl)- Ethyltrimethoxysilane, N-glycidyl-N and N-screw [3-(methyl dimethoxy silyl) propyl] amine, N-glycidyl-N and N-screw [3-(trimethoxysilyl) propyl] amine, beta-(3, 4-epoxycyclohexyl) ethyltrimethoxysilane, Gamma-glycidoxypropyltrimetoxysilane, 3-cyano butyl trichlorosilane, 2-cyano ethyl methyl dichlorosilane, 2-cyano ethyltriethoxysilane, 2-cyano ethyltrimethoxysilane, cyano methyl phenethyl triethoxysilane, 3-cyano propylmethyl dichlorosilane, 3-cyano propyl trichlorosilane, 3-cyano propyl triethoxysilane, trifluoropropyl trimetoxysilane, Trifluoro propyl trichlorosilane, nona fluoro hexyl trichlorosilane, Trideca fluoro octyl trimethoxysilane, trideca fluoro octyl trichlorosilane, Heptadeca fluoro DESHIRUMECHIRU dichlorosilane, heptadeca fluoro DESHIRU methyl dimethoxysilane, Heptadeca fluoro decyltrichlorosilane, heptadecafluorodecyl trimethoxysilane, Trideca fluoro OKUCHIRUMECHIRU dichlorosilane, trideca fluoro trichlorosilane, Trideca fluoro octyl triethoxysilane, a triethoxy silyl propyl-p-nitro benzamide, N-[3-(triethoxy silyl) propyl]-2, 4-dinitro phenylamine, A beta-trimethoxysilyl ethyl-2-pyridine, 2-[2-(trichlorosilyl) ethyl] pyridine, 4-[2-(trichlorosilyl) ethyl] pyridine, an N-(3-triethoxy silyl propyl)-p-nitro Benz amide, etc. are mentioned, and these may be used independently and may be used together.
[0014] The amount of the silane coupling agent used used in this invention has desirable 0.001 - 10 weight section to the spacer 1 weight section, and is 0.005 - 1 weight section more preferably.
[0015] As the production approach of the spacer for liquid crystal displays invention according to claim 1, the solution which dissolved the above-mentioned silane coupling agent in the suitable solvent is made to warm [it is immersed for it and] and carry out filtration afterbaking desiccation of the spacer, and the approach of forming the coat of a silane coupling agent on the surface of a spacer is mentioned to it, for example. The above-mentioned spacer may consist of the organic substance, you may consist of an inorganic substance, and they may be colored.
[0016] As a spacer which consists of the above-mentioned organic substance, for example An epoxy resin, phenol resin, Melamine resin, an unsaturated polyester resin, a divinylbenzene polymer, A divinylbenzene-styrene copolymer, a divinylbenzene-acrylic ester copolymer, The spacer which consists of cross-linking resin, such as diallyl phthalate, a triaryl isocyanate polymer, and a benzoguanamine polymer, is mentioned. Preferably It is the spacer which consists of melamine resin, a divinylbenzene polymer, a divinylbenzene-styrene copolymer, a divinylbenzene-acrylic ester copolymer, diallyl phthalate, etc.
[0017] As a spacer which consists of the above-mentioned inorganic substance, the spacer which consists of silicic-acid glass, borosilicate glass, lead glass, soda lime glass, an alumina, alumina silicate, etc. is mentioned, for example, and it is a spacer [borosilicate glass / silicic-acid glass,] preferably.

[0018] That by which the spacer which consists of the above-mentioned organic substance was processed by carbon black, a disperse dye, acid dye, basic dye, the metallic oxide, etc. as a spacer by which coloring was carried out [above-mentioned], for example; the film of the organic substance is formed in the front face of the spacer which consists of the above-mentioned inorganic substance, and what was decomposed, or carbonized and colored at the elevated temperature is mentioned. In addition, when the construction material itself which forms a spacer has the color, it may be used as it is, without coloring.
[0019] Especially the configuration of the above-mentioned spacer is not limited, for example, a true globular shape, an ellipse globular shape, and cylindrical ** are mentioned. In the case of the true ball spacer of the above, the diameter has desirable 0.1-1000 micrometers, and it is 1-100 micrometers more preferably.
[0020] In the case of the ellipse ball spacer of the above, the minor axis has desirable 0.1-1000 micrometers, it is 1-100 micrometers more preferably, as for the ratio of the major-axis pair minor axis, 1-10 are desirable, and it is 1-5 more preferably. In the case of the cylinder spacer of the above, the diameter at the base of vertical has desirable 0.5-1000 micrometers, it is 3-100 micrometers more preferably, as for the ratio of a cylindrical height pair diameter, 1-50 are desirable, and it is 1-10 more preferably.
[0021] What does not have active hydrogen which can dissolve a silane coupling agent and reacts with a silane coupling agent as a solvent in which said silane coupling agent is dissolved is desirable, for example, aliphatic series system solvents, such as aromatic solvent; hexanes, such as benzene, toluene, and a xylene, a heptane, a nonane, and Deccan, etc. are mentioned.
[0022] In addition, when a silane coupling agent has an alkoxy group, since reactivity is low compared with the case where it has a halogen atom, as a solvent, with a carbon numbers [, such as ethanol, propanol, and a butanol] of two or more alcohol may be used, and the partially aromatic solvent with which water was added by this alcohol may be used.
[0023] The amount of the above-mentioned solvent used has the desirable 1 - 100 weight section to the spacer 1 weight section, and is 3 - 20 weight section more preferably. Whenever [stoving temperature / when carrying out afterbaking desiccation / at which it was immersed in the solution obtained by a silane coupling agent dissolving the above-mentioned spacer into a solvent] has desirable 60-250 degrees C, it is 80-180 degrees C more preferably, the heating time at that time has 30 minutes - 10 desirable hours, and it is 1 - 3 hours more preferably.
[0024] In order to raise the adhesive property of the above-mentioned spacer and the thin film of the silane coupling agent formed in the front face, and in order to form the thin film of a comparatively thin silane coupling agent in homogeneity on the surface of a spacer, a titanic-acid ghost layer may be prepared between a spacer and the coat of a silane coupling agent.
[0025] After dissolving a titanate organic compound into a solvent, obtaining a solution as an approach of forming the above-mentioned titanic-acid ghost layer, for example and applying the obtained solution on the surface of a spacer, the method of making a titanic-acid ghost layer form is mentioned. The titanate organic compound applied on the surface of the spacer reacts with the hygroscopic moisture in air, and it is guessed that the above-mentioned titanic-acid ghost layer is what forms the structure which hydrolyzes and is expressed below.
[0026]
[Formula 1]



(式中、nは、正の整数を示す。)

[0027] As the above-mentioned titanate organic compound, tetra-ethoxy titanium, tetra-propoxytitanium, tetrabutoxytitanium, tetra-pentoxy titanium, tetrahexoxytitanium, tetrakis (2-ethyl HEKISOKISHI) titanium, tetradecyl alkoxy titanium, tetra stearoxy titanium, dipropoxybis (triethanol AMINATO) titanium, dihydroxy-screw (RAKUTATO) titanium, titanium-(acetylacetonate) titanium, dibutoxy-screw (triethanol AMINATO) titanium, etc. are used, for example.

[0028] As a solvent in which the above-mentioned titanate organic compound is dissolved, n-hexane, a cyclohexane, benzene, toluene, trichlene, etc. are mentioned, for example. For example, a spacer is made immersed into the solution which the titanate organic compound dissolved as an approach of applying the above-mentioned titanate organic compound on the surface of a spacer, and the method of evaporating a solvent is mentioned, fully mixing. After evaporating a solvent, it is desirable to heat at 60-150 degrees C.
[0029] Since the electric resistance of a spacer will fall if it decreases and the adhesive property of a spacer and the thin film of a silane coupling agent will fall and increase, the weight of the titanic-acid ghost layer formed on the surface of a spacer is titanium equivalent weight, and it is 2 the surface area of 1m of a spacer. Hit 0.01 - 500 mg are desirable, and are 0.1 - 100 mg more preferably.
[0030] Invention according to claim 2 is a spacer for liquid crystal display components to which it comes to carry out the coat of the front face with the thin film which consists of a silane coupling agent expressed with the following general formula (1) and (2).
R1 SiX3 (1)
(However, R1 expresses the radical which has the dipole moment of 1-5 debyes, and X expresses an alkoxy group or a halogen atom.)
R2 SiX3 (2)
(However, R2 expresses the hydrocarbon group of carbon numbers 1-20, and X expresses an alkoxy group or a halogen atom.)
[0031] As a silane coupling agent expressed with the above-mentioned general formula (1), the silane coupling agent illustrated in explanation of invention according to claim 1 is mentioned, for example. Inside R2 of the formula of the silane coupling agent expressed with the above-mentioned general formula (2) Although it promotes that a liquid crystal molecule carries out orientation of the hydrocarbon group expressed vertically to the front face of the spacer for liquid crystal display components, since the part of a hydrocarbon group will deflection-come to be easy, effectiveness will become small and it will be hard to manufacture it also industrially if the carbon number becomes large, it is limited to 1-20.
[0032] As a silane coupling agent expressed with the above-mentioned general formula (2) For example, methyl trimetoxysilane, methyl triethoxysilane, ethyltrimethoxysilane, Ethyltriethoxysilane, propyltrimethoxysilane, propyl triethoxysilane, Pro PIRUTORI butoxysilane, a propyl tripropoxy silane, butyltrimethoxysilane, Epoxybutyltriethoxysilane, a butyl tripropoxy silane, BUCHIRUTORI butoxysilane, Pentyl trimethoxysilane, pentyl triethoxysilane, hexyl trimethoxysilane, Hexyl triethoxysilane, heptyl trimethoxysilane, heptyl triethoxysilane, Octyl trimethoxysilane, octyl triethoxysilane, nonyl trimethoxysilane, Nonyl triethoxysilane, decyltrimetoxysilane, decyltriethoxysilane, Dodecyl trimethoxysilane, dodecyltriethoxysilane, octadecyltrimethoxysilane, Octadecyl triethoxysilane, methyltrichlorosilane, ethyl trichlorosilane, Propyl trichlorosilane, butyl trichlorosilane, hexyl trichlorosilane, octyl trichlorosilane, decyltrichlorosilane, octadecyl trichlorosilane, etc. are mentioned, and these may be used independently and may be used together.
[0033] The liquid crystal display component of invention according to claim 3 has a spacer for liquid crystal display components according to claim 1 or 2. The above-mentioned liquid crystal display component is expressed to drawing 4 , and is produced as follows. First, an insulator layer 11 (for example, SiO2 film) is formed, on the insulator layer 11 of each above-mentioned substrate, patterning of the transparence electric conduction film 12 (for example, ITO film) is carried out with photolithography, and it is formed in the field where the transparence substrate 10 of a couple counters, respectively. The orientation film 13, such as polyimide film, is formed on the transparence electric conduction film 12 of each above-mentioned substrate. Next, the spacer 9 for liquid crystal display components of above-mentioned this invention is sprinkled on the orientation film 13 on the above-mentioned substrate. In the case of the spacer for liquid crystal display components containing the core particle which consists of the organic substance, as for the spraying consistency of the spacer 9 for liquid crystal display components, 2 is desirable 50-200 pieces/mm, and, in the case of the spacer for liquid crystal display components containing the core particle which consists of an inorganic substance, 2 is desirable [a consistency] mm 10-100 pieces /. Then, subsequently to the empty cel between the above-mentioned substrates, a liquid crystal cell is created [these substrates] for the periphery section lamination and by pouring in liquid crystal 8 through a sealing compound 14. The liquid crystal display component 15 is obtained by giving suitable wiring for the obtained liquid crystal cell.
[0034]

[Function] In the spacer for liquid crystal display components, the ** type of the device which the thin film of a silane coupling agent which has the radical which has the dipole moment of 1-5 debyes in the front face forms is expressed to drawing 1 . First, the halogen atom and/or alkoxy group of a silane coupling agent 1 are hydrolyzed, and the permutation silanol 2 generates. Here, Y expresses the radical which has the dipole moment of 1-5 debyes. Next, the permutation silanol 2 condenses and a condensation product 3 is formed. The hydroxyl group of a condensation product 3 forms the hydrogen bond object 5 by carrying out hydrogen bond to the hydroxyl group of the front face of the titanic-acid ghost layer formed in the front face of a spacer 4 or a spacer 4. By finally heat-treating the hydrogen bond object 5, it becomes Si-O association, it is combined firmly, and the hydrogen bond object 5 forms combination 6. Therefore, the thin film of the silane coupling agent origin will be formed in the front face of a spacer 4.

[0035] Thus, the thin film of the silane coupling agent origin of the surface part of the formed spacer 9 for liquid crystal display components expresses the device to which vertical orientation of the liquid crystal molecule is carried out to drawing 2 in the interface of a liquid crystal molecule and the spacer 9 for liquid crystal display components. That is, that in which an electrostatic interaction produces between the dipole of a radical 7 which has the dipole moment of 1-5 debyes which exists in the thin film of the periphery of the spacer 9 for liquid crystal display components, and the dipole of the liquid crystal molecule 8 which exists around the radical 7, consequently the liquid crystal molecule 8 carries out vertical orientation in the interface of the spacer 9 for liquid crystal display components and the liquid crystal molecule 8 is presumed.

[0036] Moreover, the coordination of the water molecule to the radical which has the dipole moment by hydrophobic hydrocarbon-group 7' expressed with the spacer for liquid crystal display components to which it comes to apply a silane coupling agent with a silane coupling agent with the radical which has the fixed dipole moment on the surface of a spacer, and a hydrophobic hydrocarbon group to drawing 3 is controlled, and that by which the vertical orientation of the liquid crystal molecule 8 is promoted is presumed.

[0037] Furthermore, when making the aquosity dispersion medium containing alcohol distribute the spacer for liquid crystal display components and sprinkling on an electrode substrate, the spacer for liquid crystal display components is sprinkled more by homogeneity on an electrode substrate. It is presumed that the reason is that it will be in the condition that the affinity acted between the hydrocarbon group of the thin film of the silane coupling agent formed in the front face of the spacer for liquid crystal display components and the hydrocarbon group of the alcohol in an aquosity dispersion medium, consequently the front face of the spacer for liquid crystal display components was covered by the molecule of alcohol, compatibility is discovered, and it becomes easy to distribute to an aquosity dispersion medium.

[0038]

[Example] Next, the example of this invention is explained.

(1) It is SiO2 by the CVD method, respectively to the whole surface of the transparence glass plate (300mmx300mm) of the production couple of an electrode substrate. The film is vapor-deposited and it is this SiO2 further. The transparence electric conduction film ITO was formed by the sputtering method on the film on the whole surface, and the usual photolithography performed patterning.

[0039] On the ITO film of the transparence glass plate of both above, polyimide intermediate field (LP- 64 "the Toray Industries, Inc. make") were printed with the offset method, and the polyimide orientation film was formed by calcinating at 280 degrees C for 2 hours. Then, when this polyimide orientation film and a liquid crystal molecule touched, rubbing of the polyimide orientation film was performed in the direction in which the twist angle of this liquid crystal molecule becomes 240 degrees, and the electrode substrate was obtained.

[0040] With mean-particle-diameter [of 6.48 micrometers] and a standard deviation of 0.36 micrometers organic macromolecule spacer 10g obtained by carrying out the polymerization of the dipentaerythritol hexaacrylate 50 weight section and the divinylbenzene 50 weight section to the solution obtained by dissolving example 12-acetoxy ethyl trichlorosilane (dipole moment of 1.7 debyes of 2-acetoxy ethyl group) 0.2g in toluene 50ml was immersed, and mixed liquor was obtained. After warming for 1 hour, having been [55-degree C] under water bath, and stirring the obtained mixed liquor, the residue filtered and obtained was heated in the 120-degree C oven for 1 hour, and the spacer for liquid crystal display components which has the dipole moment was obtained.

[0041] It is the obtained spacer for liquid crystal display components 120 pieces/mm 2 After sprinkling on the above-mentioned electrode substrate by the consistency, seal printing was performed in the periphery section of

this electrode substrate. As a sealing compound, the 1 liquid type epoxy resin (SUTORAKUTO bond "the Mitsui Toatsu Chemicals, Inc. make") was used.

[0042] In this way, the sealing compound was stiffened by sticking two prepared electrode substrates, as each seal printing part which counters touches, and carrying out heating application of pressure at lamination and 180 degrees C for 1 hour. Subsequently, the liquid crystal display component was obtained by pouring liquid crystal into the gap of the cel of the above-mentioned electrode substrate with a conventional method.

[0043] It was checked that the disclination line based on [in the obtained liquid crystal display component] the abnormality orientation of the liquid crystal molecule in the interface of a liquid crystal molecule and the spacer for liquid crystal display components to the time of burning actuation was not observed at all, but the vertical orientation of a liquid crystal molecule has happened by the interface of a liquid crystal molecule and the spacer for liquid crystal display components.

[0044] The liquid crystal display component was obtained like the example 1 except having used 3-cyano propyl trichlorosilane (dipole moment of 3.9 debyes of 3-cyano propyl group) instead of example 22-acetoxy ethyl trichlorosilane. It was checked that the disclination line based on [in the obtained liquid crystal display component] the abnormality orientation of the liquid crystal molecule in the interface of a liquid crystal molecule and the spacer for liquid crystal display components to the time of burning actuation was not observed at all, but the vertical orientation of a liquid crystal molecule has happened by the interface of a liquid crystal molecule and the spacer for liquid crystal display components.

[0045] The liquid crystal display component was obtained like the example 1 except having used heptadeca fluoro decyltrichlorosilane (dipole moment of 2.2 debyes of a heptadeca fluoro radical) instead of example 32-acetoxy ethyl trichlorosilane. It was checked that the disclination line based on [in the obtained liquid crystal display component] the abnormality orientation of the liquid crystal molecule in the interface of a liquid crystal molecule and the spacer for liquid crystal display components to the time of burning actuation was not observed at all, but the vertical orientation of a liquid crystal molecule has happened by the interface of a liquid crystal molecule and the spacer for liquid crystal display components.

[0046] The liquid crystal display component was obtained like the example 1 except having used the TORIETOKISHI propyl-p-nitro benzamide (dipole moment of 4.1 debyes of a TORIETOKISHI propyl group) instead of example 42-acetoxy ethyl trichlorosilane, and having used ethanol / water (9:1 capacity factors) partially aromatic solvent instead of toluene. It was checked that the disclination line based on [in the obtained liquid crystal display component] the abnormality orientation of the liquid crystal molecule in the interface of a liquid crystal molecule and the spacer for liquid crystal display components to the time of burning actuation was not observed at all, but the vertical orientation of a liquid crystal molecule has happened by the interface of a liquid crystal molecule and the spacer for liquid crystal display components.

[0047] The liquid crystal display component was obtained like the example 1 except having used 2-[2-(trichlorosilyl) ethyl] pyridine (dipole moment of 2.2 debyes of 2-(2-trichlorosilyl) ethyl group) instead of example 52-acetoxy ethyl trichlorosilane. It was checked that the disclination line based on [in the obtained liquid crystal display component] the abnormality orientation of the liquid crystal molecule in the interface of a liquid crystal molecule and the spacer for liquid crystal display components to the time of burning actuation was not observed at all, but the vertical orientation of a liquid crystal molecule has happened by the interface of a liquid crystal molecule and the spacer for liquid crystal display components.

[0048] After having dissolved example 6 tetrabutoxytitanium 0.35g in 50ml n-hexane, adding the spacer particle which obtained the solution and used it for the obtained solution in the example 1 and stirring, the spacer with which the titanic-acid ghost layer was formed in the front face was obtained by evaporating n-hexane, heat-treating at 80 degrees C for 1 hour, and subsequently fully grinding this using a mortar. The liquid crystal display component was obtained like the example 1 except having used the spacer with which the obtained titanic-acid ghost layer was formed in the front face. It was checked that the disclination line based on [in the obtained liquid crystal display component] the abnormality orientation of the liquid crystal molecule in the interface of a liquid crystal molecule and the spacer for liquid crystal display components to the time of burning actuation was not observed at all, but the vertical orientation of a liquid crystal molecule has happened by the interface of a liquid crystal molecule and the spacer for liquid crystal display components.

[0049] The liquid crystal display component was obtained like the example 1 except having used N-methyl-3-aminopropyl trichlorosilane (dipole moment of 0.55 debyes of an N-methyl-3-aminopropyl radical) instead of

example of comparison 12-acetoxy ethyl trichlorosilane. It was checked that many disclination lines based on [in the obtained liquid crystal display component] the abnormality orientation of the liquid crystal molecule in the interface of a liquid crystal molecule and the spacer for liquid crystal display components to the time of burning actuation are observed, and the vertical orientation of a liquid crystal molecule has hardly happened by the interface of a liquid crystal molecule and the spacer for liquid crystal display components.

[0050] The spacer which consists of a silica with a mean particle diameter [of 6.50 micrometers] and a standard deviation of 0.19 micrometers instead of an example 7 organic macromolecule spacer is used, and it is 2 30 pieces/mm. The liquid crystal display component was obtained like the example 1 except having sprinkled on the electrode substrate by the consistency. It was checked that the disclination line based on [in the obtained liquid crystal display component] the abnormality orientation of the liquid crystal molecule in the interface of a liquid crystal molecule and the spacer for liquid crystal display components to the time of burning actuation was not observed at all, but the vertical orientation of a liquid crystal molecule has happened by the interface of a liquid crystal molecule and the spacer for liquid crystal display components.

[0051] The liquid crystal display component was obtained like the example 6 except having used 3-glycidoxypropyltrimetoxysilane (dipole moment of 1.9 debyes of 3-glycidoxy propyl group) instead of example 82-acetoxy ethyl trichlorosilane, and having used ethanol / water (9:1 capacity factors) partially aromatic solvent instead of toluene. It was checked that the disclination line based on [in the obtained liquid crystal display component] the abnormality orientation of the liquid crystal molecule in the interface of a liquid crystal molecule and the spacer for liquid crystal display components to the time of burning actuation was not observed at all, but the vertical orientation of a liquid crystal molecule has happened by the interface of a liquid crystal molecule and the spacer for liquid crystal display components.

[0052] The liquid crystal display component was obtained like the example 6 except having used 3-cyano butyl trichlorosilane (dipole moment of 3.8 debyes of 3-cyano butyl) instead of example 92-acetoxy ethyl trichlorosilane. It was checked that the disclination line based on [in the obtained liquid crystal display component] the abnormality orientation of the liquid crystal molecule in the interface of a liquid crystal molecule and the spacer for liquid crystal display components to the time of burning actuation was not observed at all, but the vertical orientation of a liquid crystal molecule has happened by the interface of a liquid crystal molecule and the spacer for liquid crystal display components.

[0053] The liquid crystal display component was obtained like the example 6 except having used nona fluoro hexyl trichlorosilane (dipole moment of 1.5 debyes of a nona fluoro hexyl group) instead of example 102-acetoxy ethyl trichlorosilane. It was checked that the disclination line based on [in the obtained liquid crystal display component] the abnormality orientation of the liquid crystal molecule in the interface of a liquid crystal molecule and the spacer for liquid crystal display components to the time of burning actuation was not observed at all, but the vertical orientation of a liquid crystal molecule has happened by the interface of a liquid crystal molecule and the spacer for liquid crystal display components.

[0054] The liquid crystal display component was obtained like the example 6 except having used propyl trichlorosilane (dipole moment of 0.5 debyes of a propyl group) instead of example of comparison 22-acetoxy ethyl trichlorosilane. It was checked that many disclination lines based on [in the obtained liquid crystal display component] the abnormality orientation of the liquid crystal molecule in the interface of a liquid crystal molecule and the spacer for liquid crystal display components to the time of burning actuation are observed, and the vertical orientation of a liquid crystal molecule has hardly happened by the interface of a liquid crystal molecule and the spacer for liquid crystal display components.

[0055] In addition, the silane coupling agent which has the dipole moment used for examples 1-10 and a list in the examples 1 and 2 of a comparison, and the existence of the disclination line in the obtained liquid crystal display component were shown in a table 1.

[0056]

[A table 1]

		シランカップリング剤（ダイポールモーメント有り）										ディスクリネーション線の有無
		A	B	C	D	E	F	G	H	I	J	
実施例	1	○										無
	2		○									無
	3			○								無
	4				○							無
	5					○						無
	6	◎										無
	7	◎*										無
	8						◎					無
	9							◎				無
	10								◎			無
比較例	1									○		有
	2										◎	有

A：2－アセトキシエチルトリクロロシラン
B：3－シアノプロピルトリクロロシラン
C：ヘプタデカフルオロデシルトリクロロシラン
D：トリエトキシプロピル－P－ニトロベンズアミド
E：2－〔2－（トリクロロシリル）エチル〕ピリジン
F：3－グリシドキシプロピルトリメトキシシラン
G：3－シアノプチルトリクロロシラン
H：ノナフルオロヘキシルトリクロロシラン
I：N－メチル－3－アミノプロピルトリクロロシラン
J：プロピルトリクロロシラン
○：スペーサにチタン酸化物層無し
◎：スペーサにチタン酸化物層有り
＊：シリカからなるスペーサ使用

[0057] Organic macromolecule spacer 10g obtained by carrying out the polymerization of 6.48 micrometers of mean diameters, the dipentaerythritol hexaacrylate 50 weight section with a standard deviation of 0.36 micrometers, and the divinylbenzene 50 weight section to the solution obtained by dissolving example 112-acetoxy ethyl trichlorosilane (dipole moment of 1.7 debyes of 2-acetoxy ethyl group) 0.2g, ethyl trichlorosilane 0.1g, and octadecyl trichlorosilane 0.1g in toluene 50ml was immersed, and mixed liquor was obtained. After warming for 1 hour, having been [55-degree C] under water bath, and stirring the obtained mixed liquor, the residue filtered and obtained was heated in the 120-degree C oven for 1 hour, and the spacer for liquid crystal display components which has the dipole moment and a hydrophobic group was obtained.

[0058] It is dispersion liquid which added the obtained spacer for liquid crystal display components at a rate of 30g to water / 1l. (capacity factors 9/1) of ethanol mixed solvents, obtained dispersion liquid, and were obtained 120 pieces/mm 2 After sprinkling on the above-mentioned electrode substrate by the consistency, seal printing was performed in the periphery section of this electrode substrate. As a sealing compound, the 1 liquid type epoxy resin (SUTORAKUTO bond "the Mitsui Toatsu Chemicals, Inc. make") was used.

[0059] In this way, the sealing compound was stiffened by sticking two prepared electrode substrates, as each seal printing part which counters touches, and carrying out heating application of pressure at lamination and 180 degrees C for 1 hour. Subsequently, the liquid crystal display component was obtained by pouring liquid crystal into the gap of the cel of the above-mentioned electrode substrate with a conventional method.

[0060] It was checked that the bright point and scotoma (disclination line) based on [in the obtained liquid crystal display component] the abnormality orientation of the liquid crystal molecule in the interface of a liquid crystal molecule and the spacer for liquid crystal display components to the time of burning actuation were not observed at all, but the vertical orientation of a liquid crystal molecule has happened by the interface of a liquid crystal molecule and the spacer for liquid crystal display components.

[0061] The liquid crystal display component was obtained like the example 11 except having used 3-cyano

propyl trichlorosilane (dipole moment of 3.9 debyes of 3-cyano propyl group) instead of example 122-acetoxy ethyl trichlorosilane, and having used octyl trichlorosilane instead of ethyl trichlorosilane and octadecyl trichlorosilane. It was checked that the disclination line based on [in the obtained liquid crystal display component] the abnormality orientation of the liquid crystal molecule in the interface of a liquid crystal molecule and the spacer for liquid crystal display components to the time of burning actuation was not observed at all, but the vertical orientation of a liquid crystal molecule has happened by the interface of a liquid crystal molecule and the spacer for liquid crystal display components.

[0062] The liquid crystal display component was obtained like the example 11 except having used heptadeca fluoro decyltrichlorosilane (dipole moment of 2.2 debyes of a heptadeca fluoro radical) instead of example 132-acetoxy ethyl trichlorosilane. It was checked that the disclination line based on [in the obtained liquid crystal display component] the abnormality orientation of the liquid crystal molecule in the interface of a liquid crystal molecule and the spacer for liquid crystal display components to the time of burning actuation was not observed at all, but the vertical orientation of a liquid crystal molecule has happened by the interface of a liquid crystal molecule and the spacer for liquid crystal display components.

[0063] The liquid crystal display component was obtained like the example 11 except having used the TORIETOKISHI propyl-p-nitro benzamide (dipole moment of 4.1 debyes of a TORIETOKISHI propyl group) instead of example 142-acetoxy ethyl trichlorosilane, having used ethyltrimethoxysilane instead of ethyl trichlorosilane, and having used octadecyltrimethoxysilane instead of octadecyl trichlorosilane. It was checked that the disclination line based on [in the obtained liquid crystal display component] the abnormality orientation of the liquid crystal molecule in the interface of a liquid crystal molecule and the spacer for liquid crystal display components to the time of burning actuation was not observed at all, but the vertical orientation of a liquid crystal molecule has happened by the interface of a liquid crystal molecule and the spacer for liquid crystal display components.

[0064] The liquid crystal display component was obtained like the example 11 except having used 2-[2-(trichlorosilyl) ethyl] pyridine (dipole moment of 2.2 debyes of 2-(2-trichlorosilyl) ethyl group) instead of example 152-acetoxy ethyl trichlorosilane. It was checked that the disclination line based on [in the obtained liquid crystal display component] the abnormality orientation of the liquid crystal molecule in the interface of a liquid crystal molecule and the spacer for liquid crystal display components to the time of burning actuation was not observed at all, but the vertical orientation of a liquid crystal molecule has happened by the interface of a liquid crystal molecule and the spacer for liquid crystal display components.

[0065] After having dissolved example 16 tetrabutoxytitanium 0.35g in 50ml n-hexane, adding the spacer particle which obtained the solution and used it for the obtained solution in the example 11 and stirring, the spacer with which the titanic-acid ghost layer was formed in the front face was obtained by evaporating n-hexane, heat-treating at 80 degrees C for 1 hour, and subsequently fully grinding this using a mortar. The liquid crystal display component was obtained like the example 1 except having used the spacer with which the obtained titanic-acid ghost layer was formed in the front face. It was checked that the disclination line based on [in the obtained liquid crystal display component] the abnormality orientation of the liquid crystal molecule in the interface of a liquid crystal molecule and the spacer for liquid crystal display components to the time of burning actuation was not observed at all, but the vertical orientation of a liquid crystal molecule has happened by the interface of a liquid crystal molecule and the spacer for liquid crystal display components.

[0066] The liquid crystal display component was obtained like the example 11 except having used N-methyl-3-aminopropyl trichlorosilane (dipole moment of 0.55 debyes of an N-methyl-3-aminopropyl radical) instead of example of comparison 32-acetoxy ethyl trichlorosilane. It was checked that many disclination lines based on [in the obtained liquid crystal display component] the abnormality orientation of the liquid crystal molecule in the interface of a liquid crystal molecule and the spacer for liquid crystal display components to the time of burning actuation are observed, and the vertical orientation of a liquid crystal molecule has hardly happened by the interface of a liquid crystal molecule and the spacer for liquid crystal display components.

[0067] A silica spacer with a mean particle diameter [of 6.50 micrometers] and a standard deviation of 0.19 micrometers is used instead of an example 17 organic macromolecule spacer, and it is 2 30 pieces/mm. The liquid crystal display component was obtained like the example 11 except having sprinkled on the electrode substrate by the consistency. It was checked that the disclination line based on [in the obtained liquid crystal display component] the abnormality orientation of the liquid crystal molecule in the interface of a liquid crystal

molecule and the spacer for liquid crystal display components to the time of burning actuation was not observed at all, but the vertical orientation of a liquid crystal molecule has happened by the interface of a liquid crystal molecule and the spacer for liquid crystal display components.

[0068] The liquid crystal display component was obtained like the example 16 except having used 3-glycidoxypropyltrimetoxysilane (dipole moment of 1.9 debyes of 3-glycidoxy propyl group) instead of example 182-acetoxy ethyl trichlorosilane, having used ethyltrimethoxysilane instead of ethyl trichlorosilane, having used octadecyltrimethoxysilane instead of octadecyl trichlorosilane, and having used ethanol / water (capacity factors 9/1) partially aromatic solvent instead of toluene. It was checked that the disclination line based on [in the obtained liquid crystal display component] the abnormality orientation of the liquid crystal molecule in the interface of a liquid crystal molecule and the spacer for liquid crystal display components to the time of burning actuation was not observed at all, but the vertical orientation of a liquid crystal molecule has happened by the interface of a liquid crystal molecule and the spacer for liquid crystal display components.

[0069] The liquid crystal display component was obtained like the example 16 except having used 3-cyano butyl trichlorosilane (dipole moment of 3.8 debyes of 3-cyano butyl) instead of example 192-acetoxy ethyl trichlorosilane. It was checked that the disclination line based on [in the obtained liquid crystal display component] the abnormality orientation of the liquid crystal molecule in the interface of a liquid crystal molecule and the spacer for liquid crystal display components to the time of burning actuation was not observed at all, but the vertical orientation of a liquid crystal molecule has happened by the interface of a liquid crystal molecule and the spacer for liquid crystal display components.

[0070] The liquid crystal display component was obtained like the example 16 except having used nona fluoro hexyl trichlorosilane (dipole moment of 1.5 debyes of a nona fluoro hexyl group) instead of example 202-acetoxy ethyl trichlorosilane. It was checked that the disclination line based on [in the obtained liquid crystal display component] the abnormality orientation of the liquid crystal molecule in the interface of a liquid crystal molecule and the spacer for liquid crystal display components to the time of burning actuation was not observed at all, but the vertical orientation of a liquid crystal molecule has happened by the interface of a liquid crystal molecule and the spacer for liquid crystal display components.

[0071] The liquid crystal display component was obtained like the example 16 except having used propyl trichlorosilane (dipole moment of 0.5 debyes of a propyl group) instead of example of comparison 42-acetoxy ethyl trichlorosilane. It was checked that many disclination lines based on [in the obtained liquid crystal display component] the abnormality orientation of the liquid crystal molecule in the interface of a liquid crystal molecule and the spacer for liquid crystal display components to the time of burning actuation are observed, and the vertical orientation of a liquid crystal molecule has hardly happened by the interface of a liquid crystal molecule and the spacer for liquid crystal display components.

[0072] In addition, the silane coupling agent which has the dipole moment used for examples 11-20 and a list in the examples 3 and 4 of a comparison, and the existence of the disclination line in the obtained liquid crystal display component were shown in a table 2, and the silane coupling agent which has the hydrophobic hydrocarbon group used together was shown in a table 3.

[0073]

[A table 2]

		シランカップリング剤（ダイポールモーメント有り）										ディスクリネーション線の有無
		A	B	C	D	E	F	G	H	I	J	
実施例	11	○										無
	12		○									無
	13			○								無
	14				○							無
	15					○						無
	16	◎										無
	17	◎*										無
	18						◎					無
	18							◎				無
	20								◎			無
比較例	3									○		有
	4										◎	有

A：２－アセトキシエチルトリクロロシラン
B：３－シアノプロピルトリクロロシラン
C：ヘプタデカフルオロデシルトリクロロシラン
D：トリエトキシプロピル－Ｐ－ニトロベンズアミド
E：２－〔２－（トリクロロシリル）エチル〕ピリジン
F：３－グリシドキシプロピルトリメトキシシラン
G：３－シアノプチルトリクロロシラン
H：ノナフルオロヘキシルトリクロロシラン
I：Ｎ－メチル－３－アミノプロピルトリクロロシラン
J：プロピルトリクロロシラン
○：スペーサにチタン酸化物層無し
◎：スペーサにチタン酸化物層有り
＊：シリカからなるスペーサ使用

[0074]
[A table 3]

		シランカップリング剤（疎水性の炭化水素基有り）
実施例	11	エチルトリクロロシラン オクタデシルトリクロロシラン
	12	オクチルトリクロロシラン
	13	エチルトリクロロシラン オクタデシルトリクロロシラン
	14	エチルトリメトキシシラン オクタデシルトリメトキシシラン
	15	エチルトリクロロシラン オクタデシルトリクロロシラン
	16	エチルトリクロロシラン オクタデシルトリクロロシラン
	17	エチルトリクロロシラン オクタデシルトリクロロシラン
	18	エチルトリメトキシシラン オクタデシルトリメトキシシラン
	19	エチルトリクロロシラン オクタデシルトリクロロシラン
	20	エチルトリクロロシラン オクタデシルトリクロロシラン
比較例	3	エチルトリクロロシラン オクタデシルトリクロロシラン
	4	エチルトリクロロシラン オクタデシルトリクロロシラン

[0075]
[Effect of the Invention] If the spacer for liquid crystal display components of this invention is used as above-mentioned, since vertical orientation of the liquid crystal molecule can be carried out, the abnormality orientation of the liquid crystal molecule in the interface of a liquid crystal molecule and the spacer for liquid crystal display components can be prevented. Therefore, a disclination line does not generate the liquid crystal display component using this spacer for liquid crystal display components at all at the time of burning actuation, but it has the outstanding display quality.
[0076] Moreover, if the aquosity dispersion medium containing alcohol is distributed and the spacer for liquid crystal display components of this invention is sprinkled on an electrode substrate, more, a spacer can be formed on an electrode substrate at homogeneity, and the liquid crystal display component which has the dramatically excellent display quality can be obtained. And since it is harmless compared with an Freon system dispersion medium, this aquosity dispersion medium does not pollute an environment.
[0077]

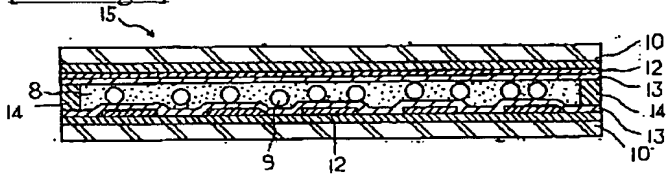
[Translation done.]

* NOTICES *

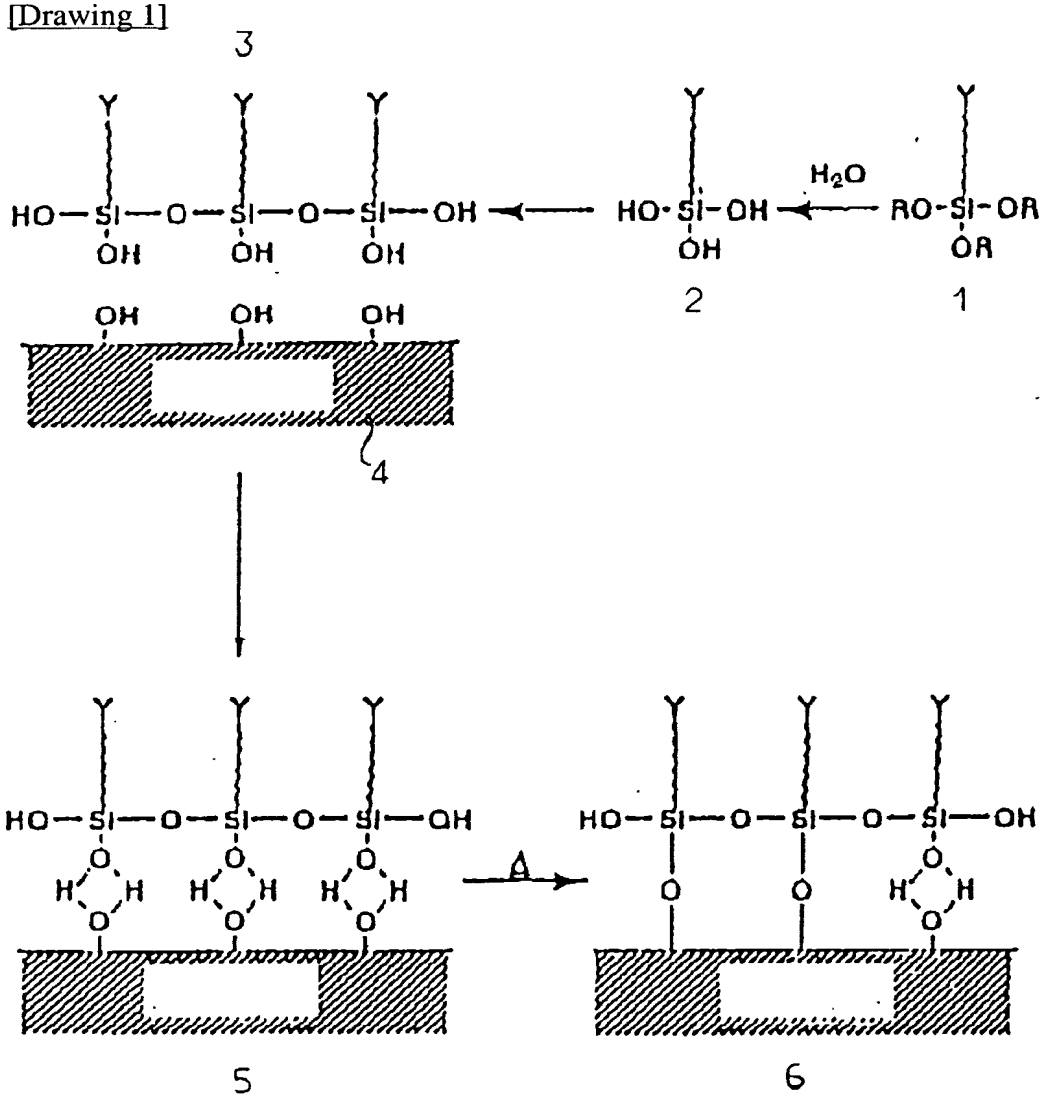
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

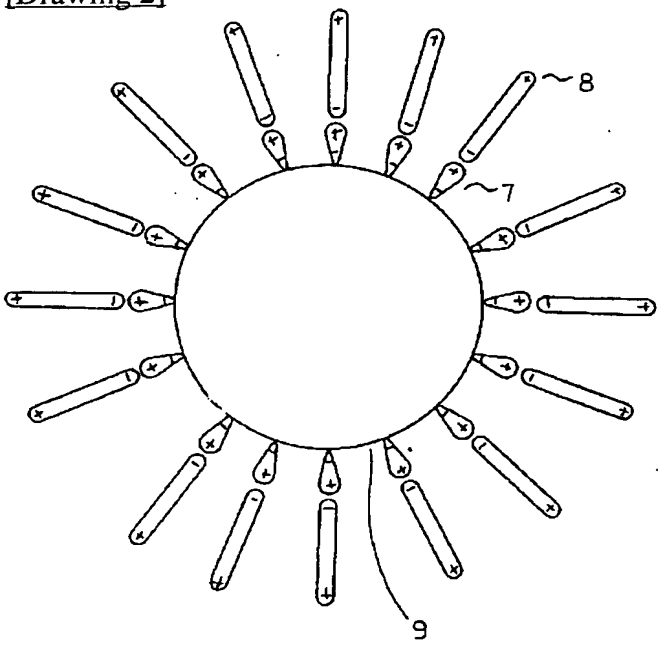
[Drawing 4]



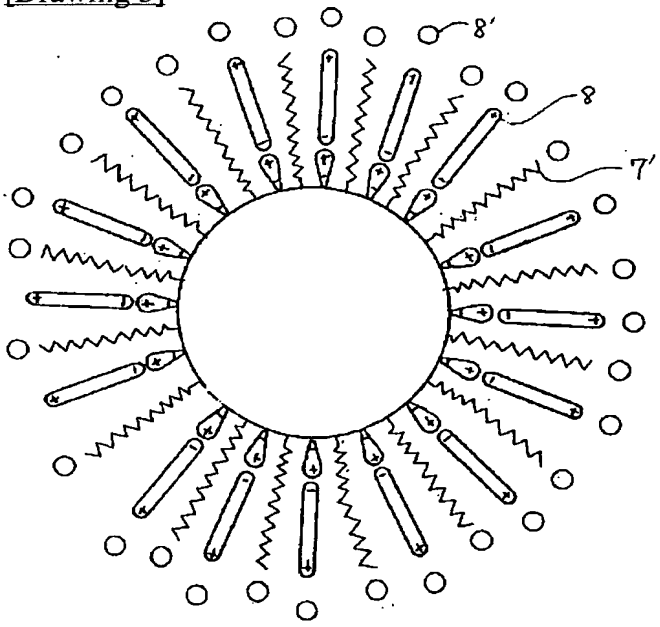
[Drawing 1]



[Drawing 2]



[Drawing 3]



[Translation done.]